Claims:

What is claimed is:

1. A method of coating a surface of a substrate with a polymer solution, comprising:

mounting the substrate inside an enclosed housing;

controlling a solvent vapor concentration of a control gas by mixing a first solvent vapor-bearing gas with a second gas having a different solvent vapor concentration;

passing the control gas into the housing through an inlet;

extruding the polymer solution onto the surface of the substrate in the housing;

spinning the substrate; and

exhausting the control gas and any solvent vapor and particulate contaminants suspended in the control gas from the housing through an outlet.

2. The method of claim 1, wherein the substrate is a wafer having a top surface, a center, and an outer edge; and

wherein extruding the polymer solution comprises extruding a ribbon of photoresist, the ribbon having a width, the ribbon covering the entire top surface of the substrate in a spiral pattern, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and with the substrate rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to

the rotating substrate is at a tangential velocity which is a constant tangential velocity.

3. A method according to claim 2, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the outer edge of the wafer and ending at the center of the wafer.

4. A method according to claim 2, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the center of the wafer and ending at the outer edge of the wafer.

5. A method according to claim 2, wherein the width of the photoresist ribbon is between about one tenth and about one third of the diameter of the wafer.

6. The method of claim 1, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing includes mounting the wafer on a chuck, the top surface of the wafer aligned horizontally and oriented upward; and

extruding the polymer solution comprises:

positioning an extrusion head adjacent to the outer edge of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located adjacent to the outer edge of the wafer, and the second end of the extrusion slot outside the outer edge of the wafer,

rotating the wafer about its center, wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity;

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width which is substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially inward from the outer edge of the wafer toward the center of the wafer until the photoresist covers the entire top of the surface of the wafer.

7. A method according to claim 6, wherein the length of the extrusion slot is between about one tenth and one third of the diameter of the semiconductor wafer.

8. A method according to claim 6, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises uniformly maintaining the extrusion slot at a distance above the top surface of the wafer.

9. A method according to claim 6, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer, and adjusting the position of the extrusion slot to maintain the distance.

10. A method according to claim 9, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer using an optical sensor.

11. A method according to claim 6, wherein the photoresist ribbon is coated onto the wafer in a spiral pattern which covers the entire top surface of the wafer.

12. A method according to claim 11, comprising the steps of removing the extrusion head, and rotating the wafer at high speed.

13. The method of claim 1, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing comprises mounting the wafer on a chuck; and

extruding the polymer solution comprises:

positioning an extrusion head at the center of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located at the center of the wafer and the second end of the extrusion slot located between the center of the wafer and the outer edge of the wafer,

rotating the wafer about its center wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity,

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width substantially equal to the length of the slot, wherein the

photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially outward toward the outer edge of the wafer until the photoresist covers the entire top surface of the wafer.

14. The method of claim 1, wherein the first solvent vapor-bearing gas and the second gas are passed to the housing along conduits in which electrically-controlled valves are mounted, the valves controlling a gas flow rate into the housing and the composition of the control gas flowing into the housing.

15. The method of claim 2, wherein the first solvent vapor-bearing gas and the second gas are passed to the housing along conduits in which electrically-controlled valves are mounted, the valves controlling a gas flow rate into the housing and the composition of the control gas flowing into the housing.

16. The method of claim 6, wherein the first solvent vapor-bearing gas and the second gas are passed to the housing along conduits in which electrically-controlled valves are mounted, the valves controlling a gas flow

rate into the housing and the composition of the control gas flowing into the housing.

17. The method of claim 13, wherein the first solvent vapor-bearing gas and the second gas are passed to the housing along conduits in which electrically-controlled valves are mounted, the valves controlling a gas flow rate into the housing and the composition of the control gas flowing into the housing.

18. The method of claim 1, wherein the control gas comprises at least one species selected from a group consisting of air, nitrogen, and noble gases.

19. The method of claim 2, wherein the control gas comprises at least one species selected from a group consisting of air, nitrogen, and noble gases.

20. The method of claim 6, wherein the control gas comprises at least one species selected from a group consisting of air, nitrogen, and noble gases.

21. The method of claim 13, wherein the control gas comprises at least one species selected from a group consisting of air, nitrogen, and noble gases.

22. The method of claim 1, wherein the polymer solution contains a photoresist polymer.

23. The method of claim 2, wherein the polymer solution contains a photoresist polymer.

24. The method of claim 6, wherein the polymer solution contains a photoresist polymer.

25. The method of claim 13, wherein the polymer solution contains a photoresist polymer.

26. A method of claim , wherein the polymer solution contains a photoresist polymer.

27. The method of claim 1, further comprising passing solvent-free, humid gas over the coated substrate.

28. The method of claim 2, further comprising passing solvent-free, humid gas over the coated substrate.

29. The method of claim 6, further comprising passing solvent-free, humid gas over the coated substrate.

30. The method of claim 13, further comprising passing solvent-free, humid gas over the coated substrate.

31. The method of claim 27, wherein a humidity of the humid gas is controlled by means of a temperature and humidity controller.

32. The method of claim 31, wherein the humidity of a humid gas is controlled to have the relative humidity in the range of 40% to 45%.

33. The method of claim 27, wherein the temperature of the humid gas is controlled by means of a temperature and humidity controller.

34. A method of coating a surface of a substrate with a polymer solution, comprising:

mounting the substrate inside an enclosed housing;

passing the control gas into the housing through an inlet;

extruding the polymer solution onto the surface of the substrate in the housing;

passing solvent-free dry, filtered gas over the coated substrate;

spinning the substrate; and

exhausting the control gas and any solvent vapor and particulate contaminants suspended in the control gas from the housing through an outlet.

35. The method of claim 34, wherein the substrate is a wafer having a top surface, a center, and an outer edge; and

wherein extruding the polymer solution comprises extruding a ribbon of photoresist, the ribbon having a width, the ribbon covering the entire top surface of the substrate in a spiral pattern, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and with the substrate rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating substrate is at a tangential velocity which is a constant tangential velocity.

36. A method according to claim 35, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the outer edge of the wafer and ending at the center of the wafer.

37. A method according to claim 35, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the center of the wafer and ending at the outer edge of the wafer.

38. A method according to claim 35, wherein the width of the photoresist ribbon is between about one tenth and about one third of the diameter of the wafer.

39. The method of claim 34, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing includes mounting the wafer on a chuck, the top surface of the wafer aligned horizontally and oriented upward; and

extruding the polymer solution comprises:

positioning an extrusion head adjacent to the outer edge of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located adjacent to the outer edge of the wafer, and the second end of the extrusion slot outside the outer edge of the wafer,

rotating the wafer about its center, wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity;

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width which is substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially inward from the outer edge of the wafer toward the center of the wafer until the photoresist covers the entire top of the surface of the wafer.

40. A method according to claim 39, wherein the length of the extrusion slot is between about one tenth and one third of the diameter of the semiconductor wafer.

41. A method according to claim 39, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises uniformly maintaining the extrusion slot at a distance above the top surface of the wafer.

42. A method according to claim 41, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer, and adjusting the position of the extrusion slot to maintain the distance.

43. A method according to claim 42, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer using an optical sensor.

44. A method according to claim 39, wherein the photoresist ribbon is coated onto the wafer in a spiral pattern which covers the entire top surface of the wafer.

45. A method according to claim 44, comprising the steps of

removing the extrusion head, and

rotating the wafer at high speed.

46. The method of claim 34, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing comprises mounting

the wafer on a chuck; and

extruding the polymer solution comprises:

positioning an extrusion head at the center of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located at the center of the wafer and the second end of the extrusion slot located between the center of the wafer and the outer edge of the wafer,

rotating the wafer about its center wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity,

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially outward toward the outer edge of the wafer until the photoresist covers the entire top surface of the wafer.

47. A method of coating a surface of a substrate with a polymer solution, comprising:

mounting the substrate inside an enclosed housing;

passing the control gas into the housing through an inlet;

extruding the polymer solution onto the surface of the substrate in the housing;

passing solvent-free dry, filtered gas over the coated substrate, wherein a temperature of the solvent-free dry, filtered gas is controlled;

spinning the substrate; and

exhausting the control gas and any solvent vapour and particulate contaminants suspended in the control gas from the housing through an outlet.

48. The method of claim 47, wherein the substrate is a wafer having a top surface, a center, and an outer edge; and

wherein extruding the polymer solution comprises extruding a ribbon of photoresist, the ribbon having a width, the ribbon covering the entire top surface of the substrate in a spiral pattern, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and with the substrate rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating substrate is at a tangential velocity which is a constant tangential velocity.

49. A method according to claim 48, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the outer edge of the wafer and ending at the center of the wafer.

50. A method according to claim 48, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the center of the wafer and ending at the outer edge of the wafer.

51. A method according to claim 48, wherein the width of the photoresist ribbon is between about one tenth and about one third of the diameter of the wafer.

52. The method of claim 47, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing includes mounting the wafer on a chuck, the top surface of the wafer aligned horizontally and oriented upward; and

extruding the polymer solution comprises:

positioning an extrusion head adjacent to the outer edge of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length

bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located adjacent to the outer edge of the wafer, and the second end of the extrusion slot outside the outer edge of the wafer,

rotating the wafer about its center, wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity;

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width which is substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially inward from the outer edge of the wafer toward the center of the wafer until the photoresist covers the entire top of the surface of the wafer.

53. A method according to claim 52, wherein the length of the extrusion slot is between about one tenth and one third of the diameter of the semiconductor wafer.

54. A method according to claim 52, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises uniformly maintaining the extrusion slot at a distance above the top surface of the wafer.

55. A method according to claim 54, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer, and adjusting the position of the extrusion slot to maintain the distance.

56. A method according to claim 55, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer using an optical sensor.

57. A method according to claim 52, wherein the photoresist ribbon is coated onto the wafer in a spiral pattern which covers the entire top surface of the wafer.

58. A method according to claim 57, comprising the steps of

removing the extrusion head, and

rotating the wafer at high speed.

59. The method of claim 47, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing comprises mounting the wafer on a chuck; and

extruding the polymer solution comprises:

positioning an extrusion head at the center of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located at the center of the wafer and the second end of the extrusion slot located between the center of the wafer and the outer edge of the wafer,

rotating the wafer about its center wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity,

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the

extrusion head radially outward toward the outer edge of the wafer until the photoresist covers the entire top surface of the wafer.

60. A method for coating a surface of a substrate with a polymer solution, comprising:

mounting the substrate within an enclosed housing;

extruding a solvent-bearing polymer solution onto the substrate; and

controlling the evaporation of solvent from the polymer solution by adjusting an amount of solvent introduced into the housing environment, wherein adjusting the amount of solvent introduced into the housing environment comprises adjusting a degree of saturation of a control gas introduced into the housing environment by mixing a plurality of gases having differing solvent vapor partial pressures to form the control gas.

61. The method of claim 60, wherein the substrate is a wafer having a top surface, a center, and an outer edge; and

wherein extruding the polymer solution comprises extruding a ribbon of photoresist, the ribbon having a width, the ribbon covering the entire top surface of the substrate in a spiral pattern, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and with the substrate rotating at a rotational speed, and the extrusion head moving at a

radial speed, the motion of a radially moving extrusion head with respect to the rotating substrate is at a tangential velocity which is a constant tangential velocity.

62. A method according to claim 61, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the outer edge of the wafer and ending at the center of the wafer.

63. A method according to claim 61, wherein the ribbon of photoresist is extruded in a spiral pattern beginning at the center of the wafer and ending at the outer edge of the wafer.

64. A method according to claim 61, wherein the width of the photoresist ribbon is between about one tenth and about one third of the diameter of the wafer.

65. The method of claim 60, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing includes mounting the wafer on a chuck, the top surface of the wafer aligned horizontally and oriented upward; and

extruding the polymer solution comprises:

positioning an extrusion head adjacent to the outer edge of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located adjacent to the outer edge of the wafer, and the second end of the extrusion slot outside the outer edge of the wafer,

rotating the wafer about its center, wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity;

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width which is substantially equal to the length of the slot, wherein the photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially inward from the outer edge of the wafer toward the center of the wafer until the photoresist covers the entire top of the surface of the wafer.

66. A method according to claim 65, wherein the length of the extrusion slot is between about one tenth and one third of the diameter of the semiconductor wafer.

67. A method according to claim 65, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises uniformly maintaining the extrusion slot at a distance above the top surface of the wafer.

68. A method according to claim 67, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer, and adjusting the position of the extrusion slot to maintain the distance.

69. A method according to claim 68, wherein maintaining the extrusion slot aligned radially with respect to the wafer further comprises determining a distance between the extrusion slot and the top surface of the wafer using an optical sensor.

70. A method according to claim 65, wherein the photoresist ribbon is coated onto the wafer in a spiral pattern which covers the entire top surface of the wafer.

71. A method according to claim 70, comprising the steps of removing the extrusion head, and rotating the wafer at high speed.

72. The method of claim 60, wherein:

the substrate is a wafer having a top surface, a center, a diameter, and an outer edge;

mounting the substrate inside an enclosed housing comprises mounting the wafer on a chuck; and

extruding the polymer solution comprises:

positioning an extrusion head at the center of the wafer and above the top surface of the wafer, the extrusion head configured to extrude photoresist out an extrusion slot, the extrusion slot having a length bounded by a first end and a second end, the extrusion head positioned with the extrusion slot aligned radially with respect to the wafer, the first end of the extrusion slot located at the center of the wafer and the second end of the extrusion slot located between the center of the wafer and the outer edge of the wafer,

rotating the wafer about its center wherein with the wafer rotating at a rotational speed, and the extrusion head moving at a radial speed, the motion of a radially moving extrusion head with respect to the rotating wafer is at a tangential velocity which is a constant tangential velocity,

extruding a ribbon of photoresist from the extrusion slot, the ribbon having a width substantially equal to the length of the slot, wherein the

photoresist is extruded from the extrusion slot at a rate which is a constant extrusion rate, and

while extruding photoresist from the extrusion slot, and maintaining the extrusion slot aligned radially with respect to the wafer, moving the extrusion head radially outward toward the outer edge of the wafer until the photoresist covers the entire top surface of the wafer.

73. The method of claim 60, wherein adjusting an amount of solvent in the housing environment further comprises creating a uniform flow of control gas within the housing at a location distal to the substrate, the flow being substantially normal to the substrate.

74. The method of claim 61, wherein adjusting an amount of solvent in the housing environment further comprises creating a uniform flow of control gas within the housing at a location distal to the substrate, the flow being substantially normal to the substrate.

75. The method of claim 65, wherein adjusting an amount of solvent in the housing environment further comprises creating a uniform flow of control gas within the housing at a location distal to the substrate, the flow being substantially normal to the substrate.

76. The method of claim 72, wherein adjusting an amount of solvent in the housing environment further comprises creating a uniform flow of control gas within the housing at a location distal to the substrate, the flow being substantially normal to the substrate.

77. The method of claim 60, wherein the control gas is adjusted to be saturated with solvent vapor.

78. The method of claim 61, wherein the control gas is adjusted to be saturated with solvent vapor.

79. The method of claim 65, wherein the control gas is adjusted to be saturated with solvent vapor.

80. The method of claim 72, wherein the control gas is adjusted to be saturated with solvent vapor.

81. The method of claim 60, wherein adjusting an amount of solvent in the housing environment further comprises controlling a liquid solvent temperature.

82. The method of claim 61, wherein adjusting an amount of

solvent in the housing environment further comprises controlling a liquid solvent temperature.

83. The method of claim 65, wherein adjusting an amount of solvent in the housing environment further comprises controlling a liquid solvent temperature.

84. The method 72, wherein adjusting an amount of solvent in the housing environment further comprises controlling a liquid solvent temperature.

85. The method of claim 60, wherein adjusting an amount of solvent in the housing environment further comprises controlling a gas pressure in a solvent tank.

86. The method of 61, wherein adjusting an amount of solvent in the housing environment further comprises controlling a gas pressure in a solvent tank.

87. The method of claim 65, wherein adjusting an amount of solvent in the housing environment further comprises controlling a gas pressure in a solvent tank.

88. The method of claim 72, wherein adjusting an amount of solvent in the housing environment further comprises controlling a gas pressure in a solvent tank.

89. The method of claim 60, wherein the control gas is adjusted to be unsaturated with solvent vapor.

90. The method of claim 61, wherein the control gas is adjusted to be unsaturated with solvent vapor.

91. The method of claim 65, wherein the control gas is adjusted to be unsaturated with solvent vapor.

92. The method of 72, wherein the control gas is adjusted to be unsaturated with solvent vapor.

93. The method of claim 89, wherein the degree of saturation of the control gas is controlled by varying a control gas temperature.

94. The method of claim 89, wherein varying a control gas pressure controls the degree of saturation of the control gas.

95. The method of claim 60, wherein controlling the evaporation of

solvent from the polymer solution further comprises controlling a solvent concentration flux within the housing.

96. The method of claim 61, wherein controlling the evaporation of solvent from the polymer solution further comprises controlling a solvent concentration flux within the housing.

97. The method of claim 65, wherein controlling the evaporation of solvent from the polymer solution further comprises controlling a solvent concentration flux within the housing.

98. The method of claim 72, wherein controlling the evaporation of solvent from the polymer solution further comprises controlling a solvent concentration flux within the housing.

99. The method of claim 95, wherein the solvent concentration flux in the housing is controlled by varying a temperature within the housing.

100. The method of claim 95, wherein the solvent concentration flux in the housing is controlled by varying a pressure within the housing.

101. The method of claim 95, wherein the solvent concentration flux in the housing is controlled by varying a solvent velocity within the housing.

102. The method of claim 95, wherein varying a solvent concentration flux in the housing includes varying the velocity of a substantially uniform gas flow developed distal to the wafer.

103. The method of claim 100, wherein a solvent concentration flux in the housing is controlled by varying a solvent velocity within the housing.

104. The method of claim 100, wherein a solvent concentration flux in the housing is controlled by varying a substantially uniform gas flow within the housing distal to the wafer.

105 The method of claim 104, wherein the substantially uniform gas flow develops from a showerhead comprising at least one orifice.

106 The method of claim 104, wherein the substantially uniform gas flow develops from a showerhead comprising a plurality of orifices.

107. The method of claim 106, wherein a distance separating the showerhead from the substrate is greater than a distance separating sequential showerhead orifices.

108. The method of claim 106, wherein a distance separating the showerhead from the substrate is greater than a distance separating sequential showerhead orifices by at least a factor of 5.

109. A method for coating a surface of a substrate, comprising:

mounting the substrate within an enclosed housing;

extruding a solvent-bearing solution onto the substrate; and

controlling the evaporation of solvent from the solution by adjusting an amount of solvent introduced into the housing environment, wherein adjusting the amount of solvent introduced into the housing environment comprises adjusting a degree of saturation of a control gas introduced into the housing environment within the range between 0 % and approximately 40%. by mixing a plurality of gases having differing solvent vapor partial pressures to form the control gas.

110. The method of claim 109, further comprising rotating the substrate.

111. The method of claim 110, wherein the substrate is rotated at a variable speed.

112. The method of claim 110, wherein the substrate is rotated at a rotational speed of less than approximately 2000 rpm.

113. The method of claim 110, wherein the substrate rotates for a time sufficient to provide a one sigma film uniformity of no more than 4.0 Angstrom over the substrate.

114. The method of claim 110, wherein the substrate rotates for a time sufficient to provide a film uniformity of less than 0.05% over the substrate.